Università degli Studi di Ferrara | Dipartimento di Scienze della Vita e Biotecnologie

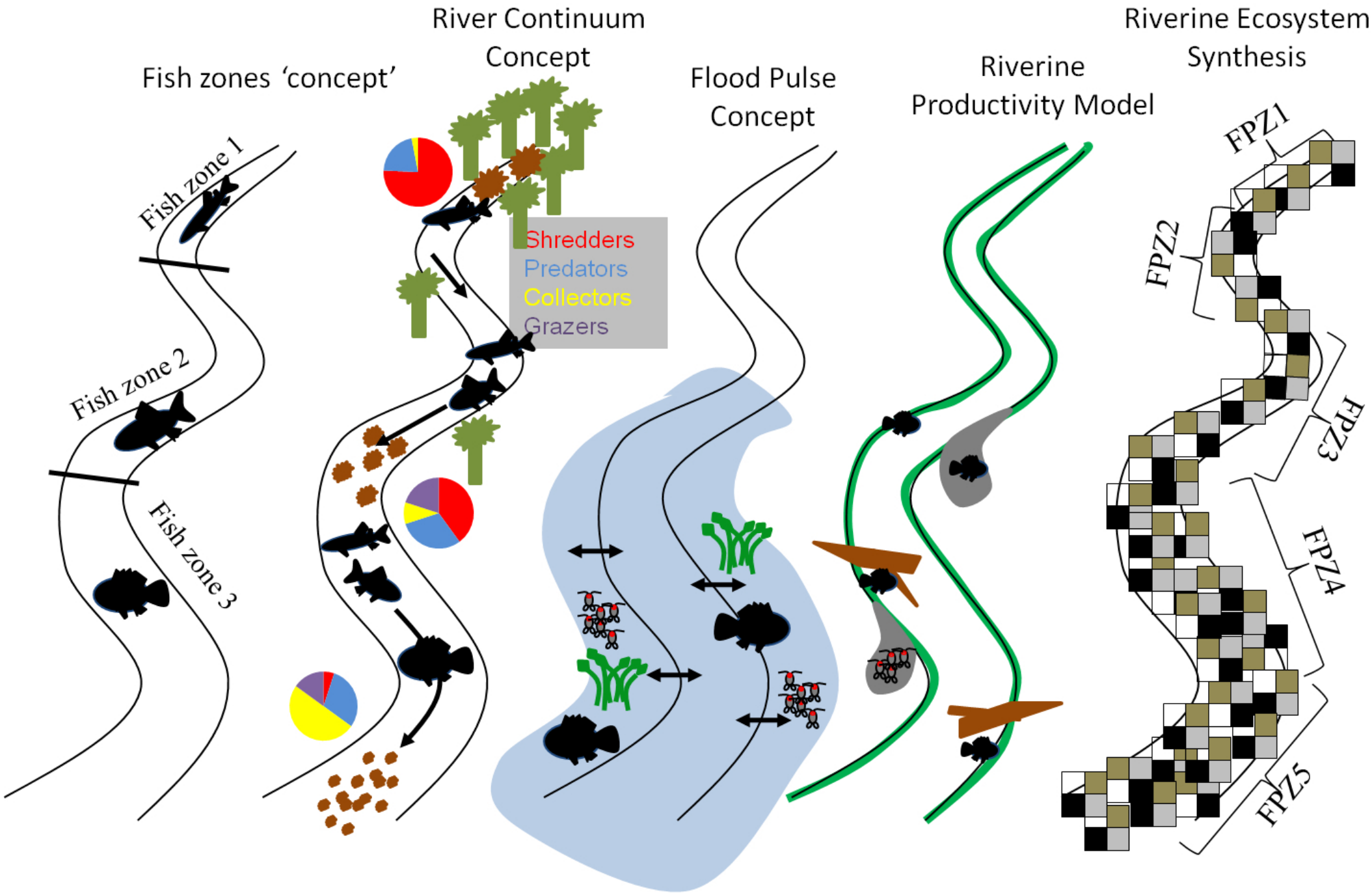
LifeWatch ITALIA

Macrobenthic variability in streams and rivers of Northern Italy

Gaglio M., Muresan A.N., Castaldelli G., Fano E.A.

Department of Life Sciences and Biotechnology, University of Ferrara. Via Borsari 46, 44121 Ferrara (Italy)

LifeWatch Italy Annual Conference – Rome 25-27 June 2018


Fish zones 'concept'
Fish zone 1
Fish zone 2
Fish zone 3
River Continuum Concept
Shredders
Predators
Collectors
Grazers
Flood Pulse Concept
Riverine Productivity Model
Riverine Ecosystem Synthesis
FPZ1
FPZ2
FPZ3
FPZ4
FPZ5

e River Continuum Concept (RCC)

ote et al 1980

vers as gradients:

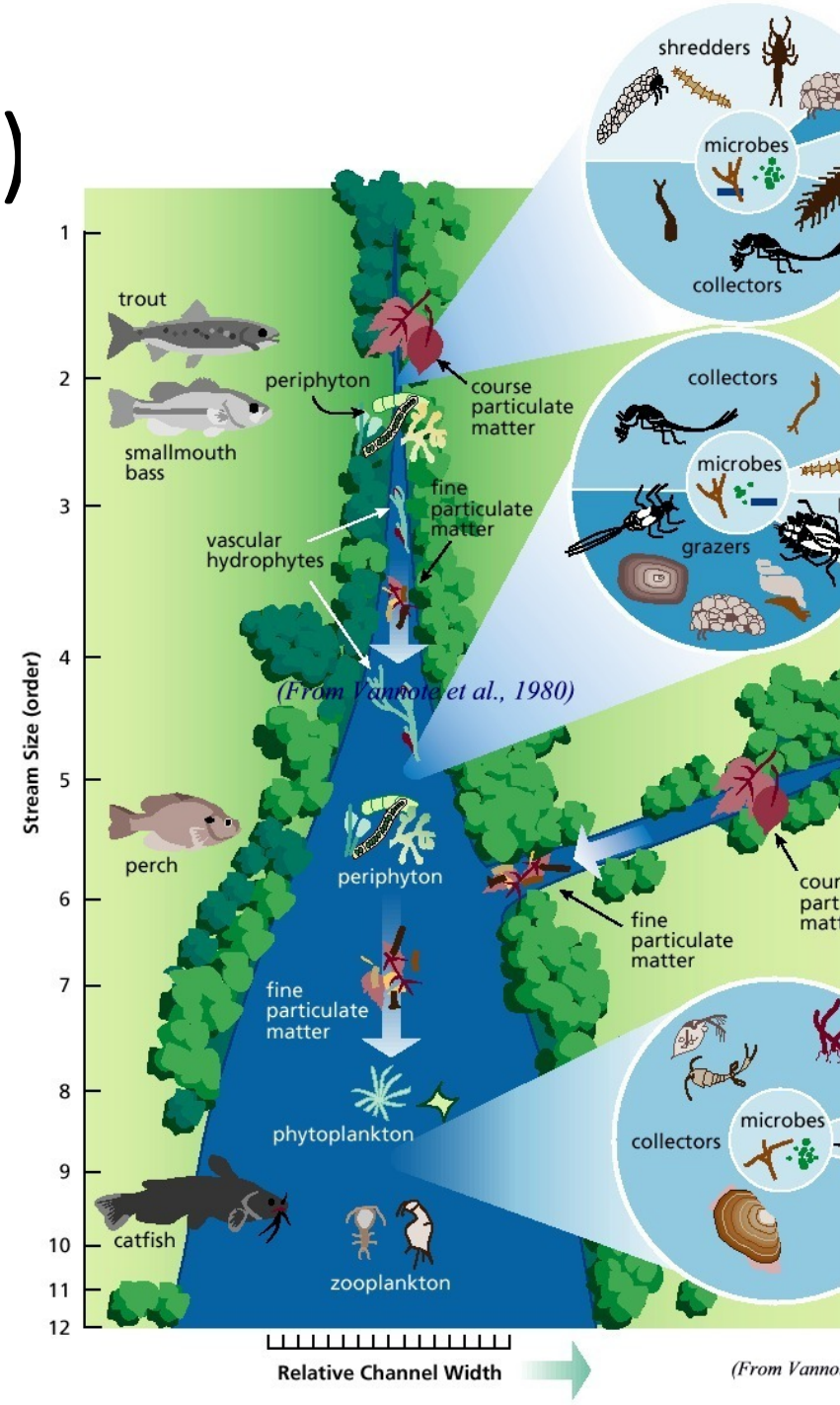
An array of physical, chemical and biological characteristics change continually and gradually with distance downstream

umpions:

ntinuous gradient from headwaters to mouth

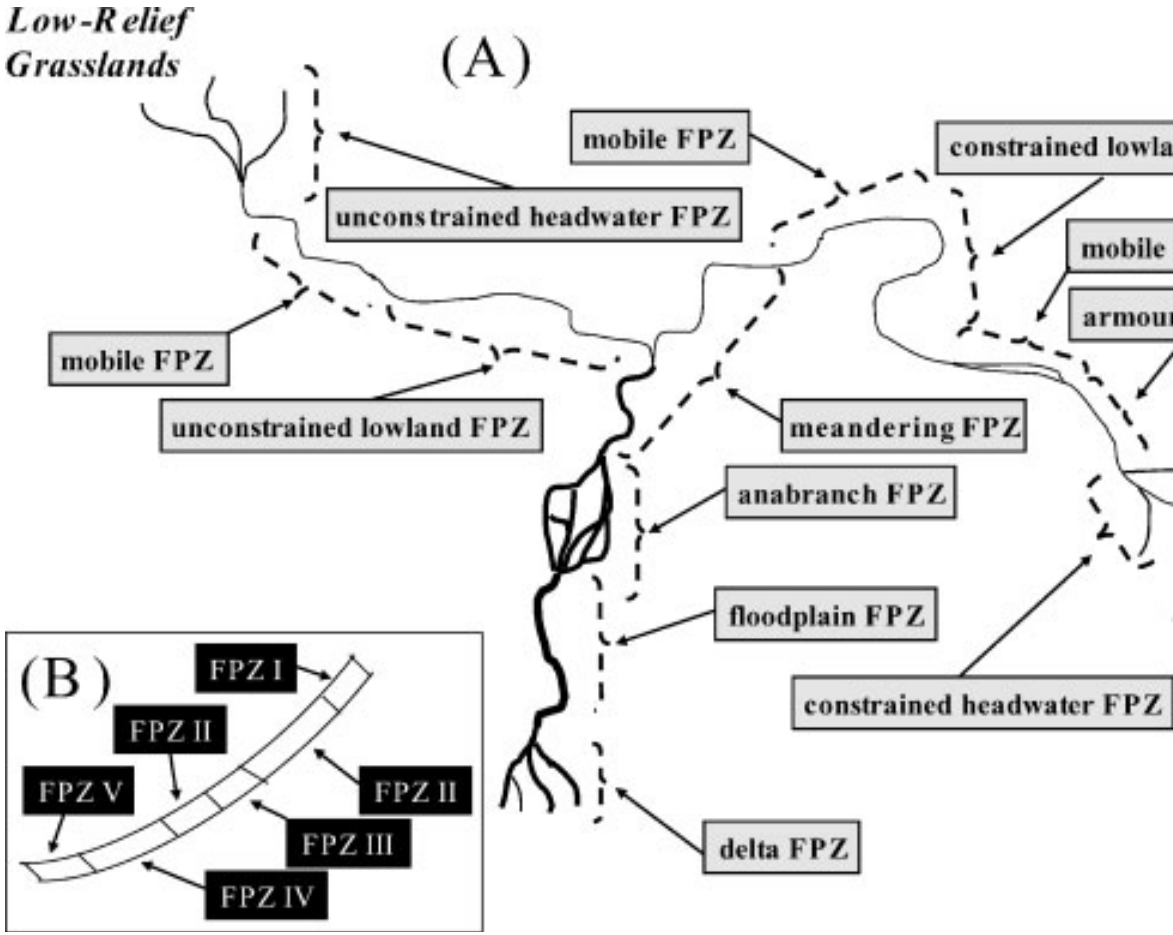
rested watershed

onstant riparian vegetation



ne Riverine Ecosystem ynthesis (RES) (Thorpe et al 06)

- Four-dimensions of rivers (longitudinal, lateral, vertical, and temporal)
- Patches of particular interest are *functional process zones* (FPZs) which are large hydrogeomorphically distinct patches that exist between the river valley and reach scale



Study area

16 rivers of Northern Italy
with limited human impacts

61 sampling site

19527 replicates (summer)

Trentino Alto Adige

- Adige
- Aurino
- Arnò
- Isarco
- Passirio
- Rienza
- Sarca
- Vanoi

Lombardia

- Brembilla
- Brembo
- Serina

Veneto

- Caorame
- Cordevole
- Mis
- Piave
- Stien

Enviromental parameters

ameters	Unit	Abbrev.	Transformation	Mean	Max	Min
ance from spring	km	Dist	log (x+1)	32.31	190.00	1.0
gitude	Dec. degrees	Long	log (x+1)	46.24	46.94	45.7
tude	Dec. degrees	Lat	log (x+1)	11.28	12.69	9.5
tude	m a.s.l	Alt	log (x+1)	683.84	1670	15
hi)	-	Substr	none	-5.21	4	
phyton and macrophytes	Ordinal [0;5]	Veg_cov	none	1.10	5	
arian vegetation	Ordinal [1;8]	Veg_rip	none	5.62	8	
urality of surrounding land use	Ordinal [0;8]	Land use	none	5.61	8	
an depth of riverbed	cm	MeanDepth	log (x+1)	26.19	100.00	0.0
nperature	°C	Temp	log (x+1)	12.02	20.90	6.8
olved oxygen	mg l^{-1}	DO	log (x+1)	10.10	14.01	7.2
monium	mg l^{-1}	NH4	log (x+1)	33.15	191.00	0.0
ate	mg l^{-1}	NO3	log (x+1)	0.71	2.00	0.1

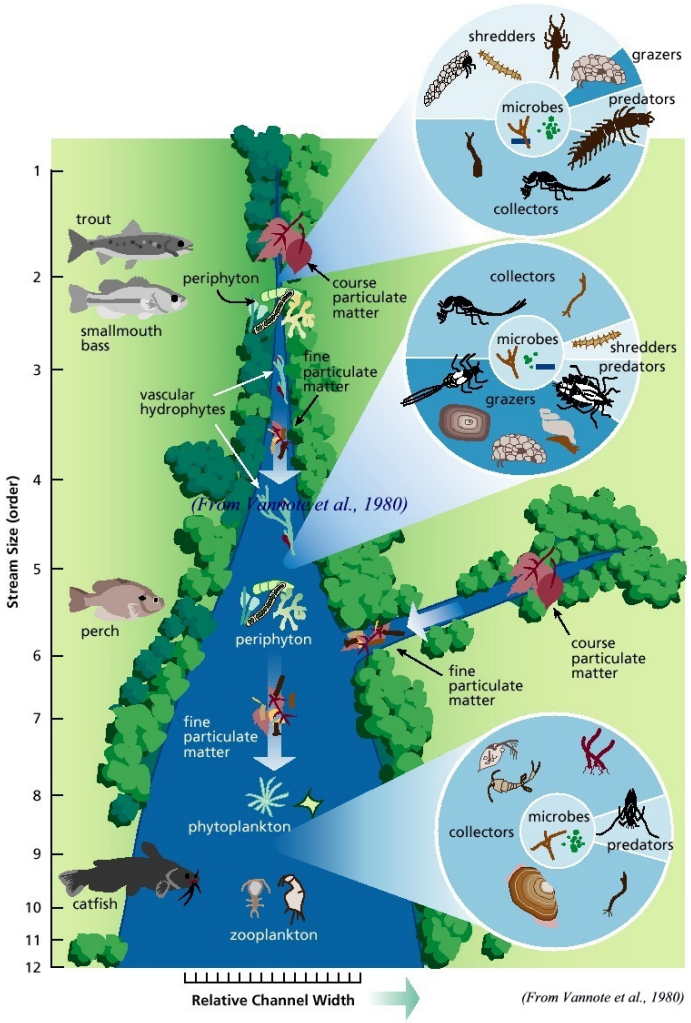
ONGITUDINAL DIMENSION

tance from
ing

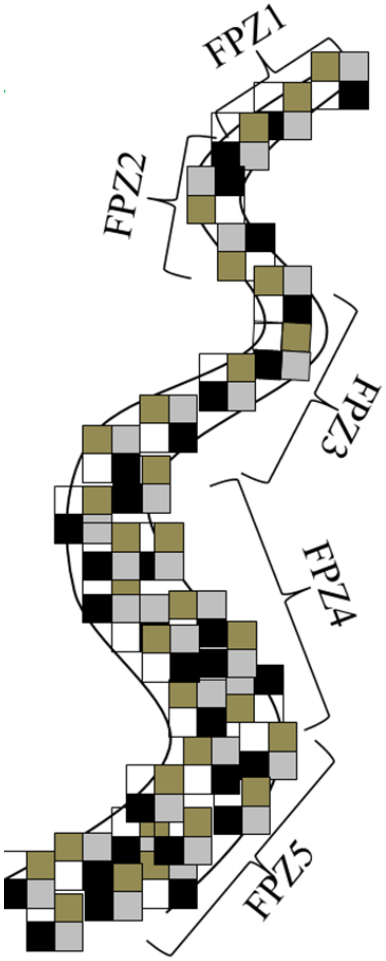
tude

an depth of
erbed

RCC



RES



LATERAL DIMENSION

Substrate

Aquatic vegetati

Riparian vegetat

Surrounding lan
use

nviromental parameters for lateral dimension

ubstrate (granulometry, based on Wentworth
ale) $\varphi\,(\mathrm{phi}) = -\log\downarrow 2\ \square D/D\downarrow 0$

parian vegetation

8 - Canopy
7 - Trees
6 - Trees and bushes
5 - Trees and grass
4 - Bushes
3 - Bushes and grass
2 - Sparse bushes
1 - Grassland

Aquatic vegetation

From 0 (absent) to 5 (very abundan

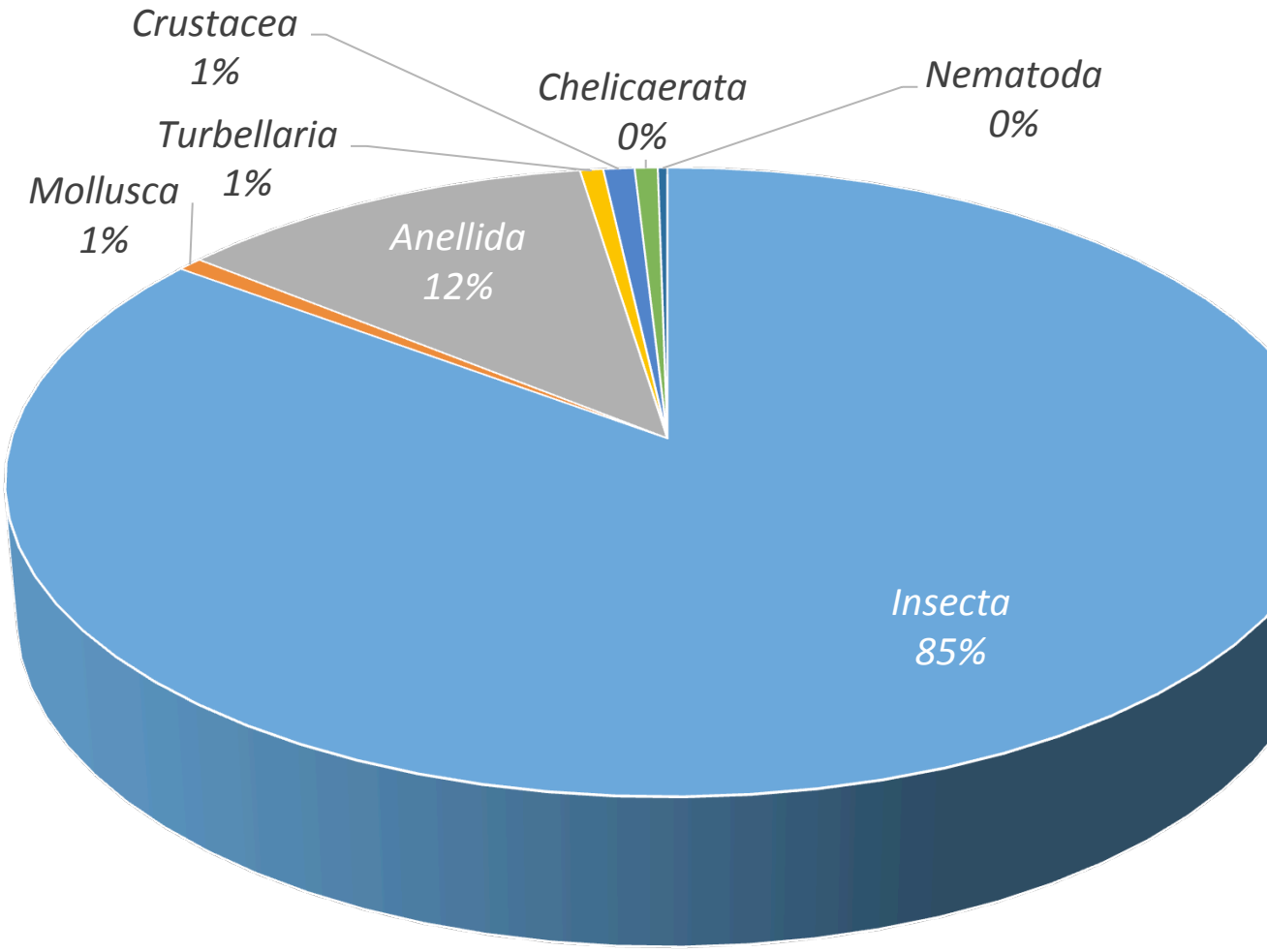
Naturality of surronding land use

8 - Forest
7 - Forest and grassland
6 - Forest and agriculture
5 - Grassland
4 - Sparse grassland
3 - Grassland and agriculture
2 - Agriculture
1 - Urban with forest
0 - Urban

Results: taxa

69 taxa belonging to:

- *Insecta* (48)
- *Annellida* (6)
- *Mollusca* (8)
- *Turbellaria* (3)
- *Crustacea* (2)
- *Chelicerata* (1)
- *Nematoda*

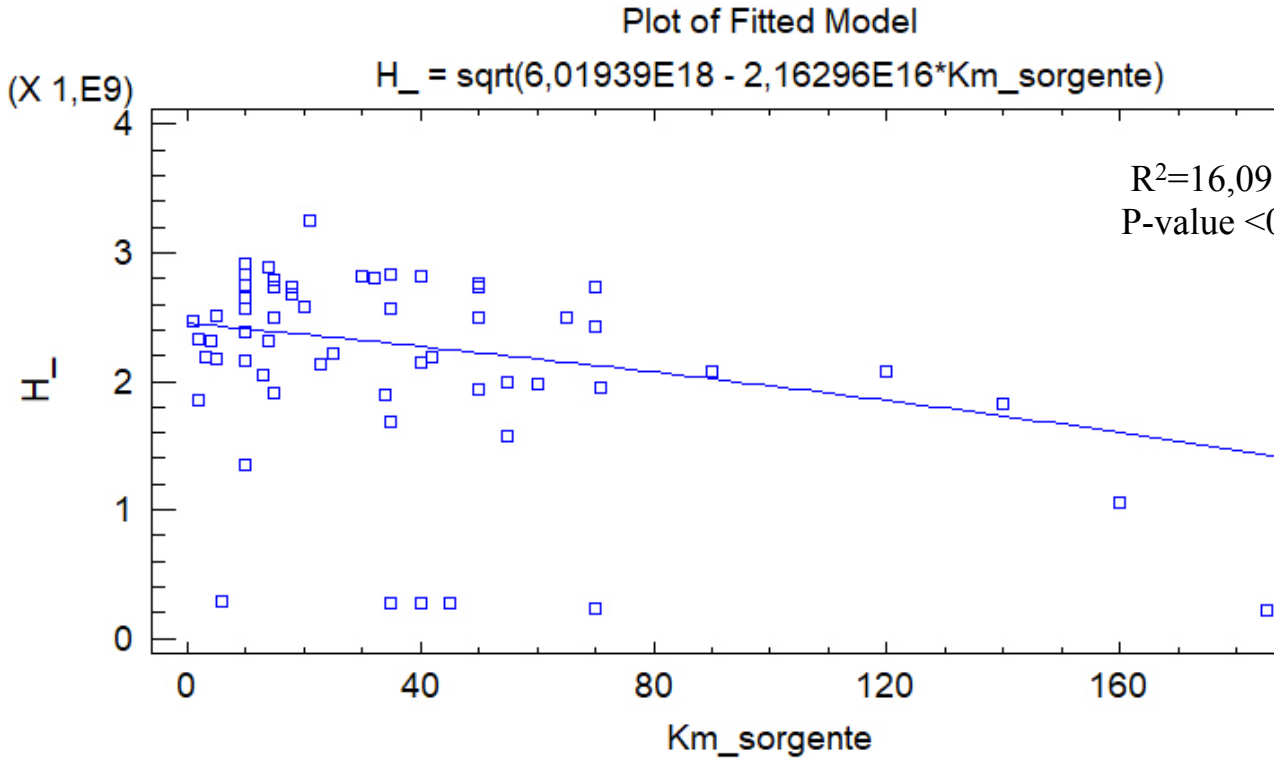


ctors affecting macrobenthic biodiversity

rrelations (Spearman Rank)

annon diversity Index (H') has <u>NEGATIVE</u> significant correlations with:

NH4
NO3
Temperature
<u>Distance from spring</u>



ctors affecting macrobenthic biodiversity

rrelations (Spearman Rank)

lou Index (J) has <u>NEGATIVE</u> significant correlations with:

Substrate (granulometry)
NH4
NO3
Temperature
Latitude

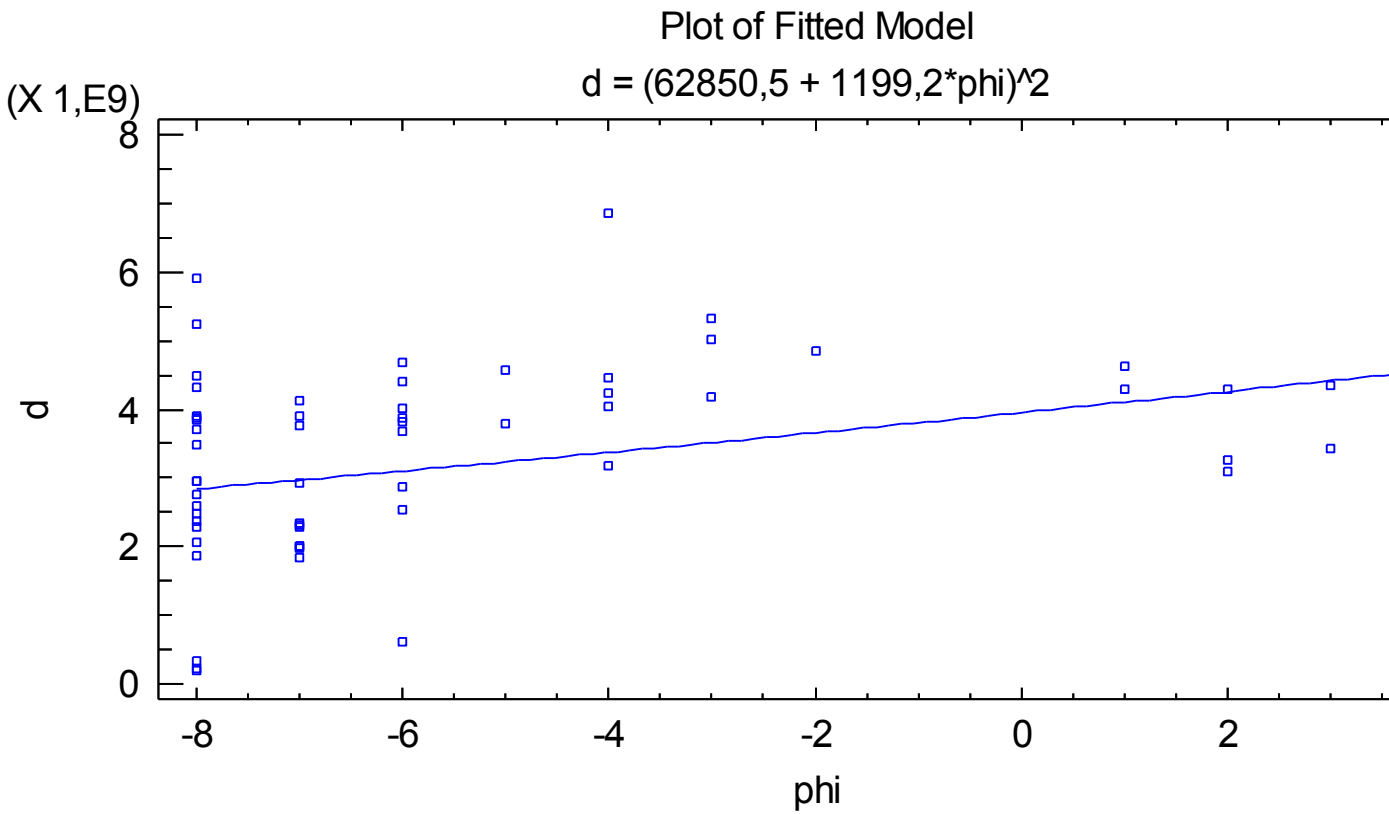
ctors affecting macrobenthic biodiversity

rrelations (Spearman Rank)

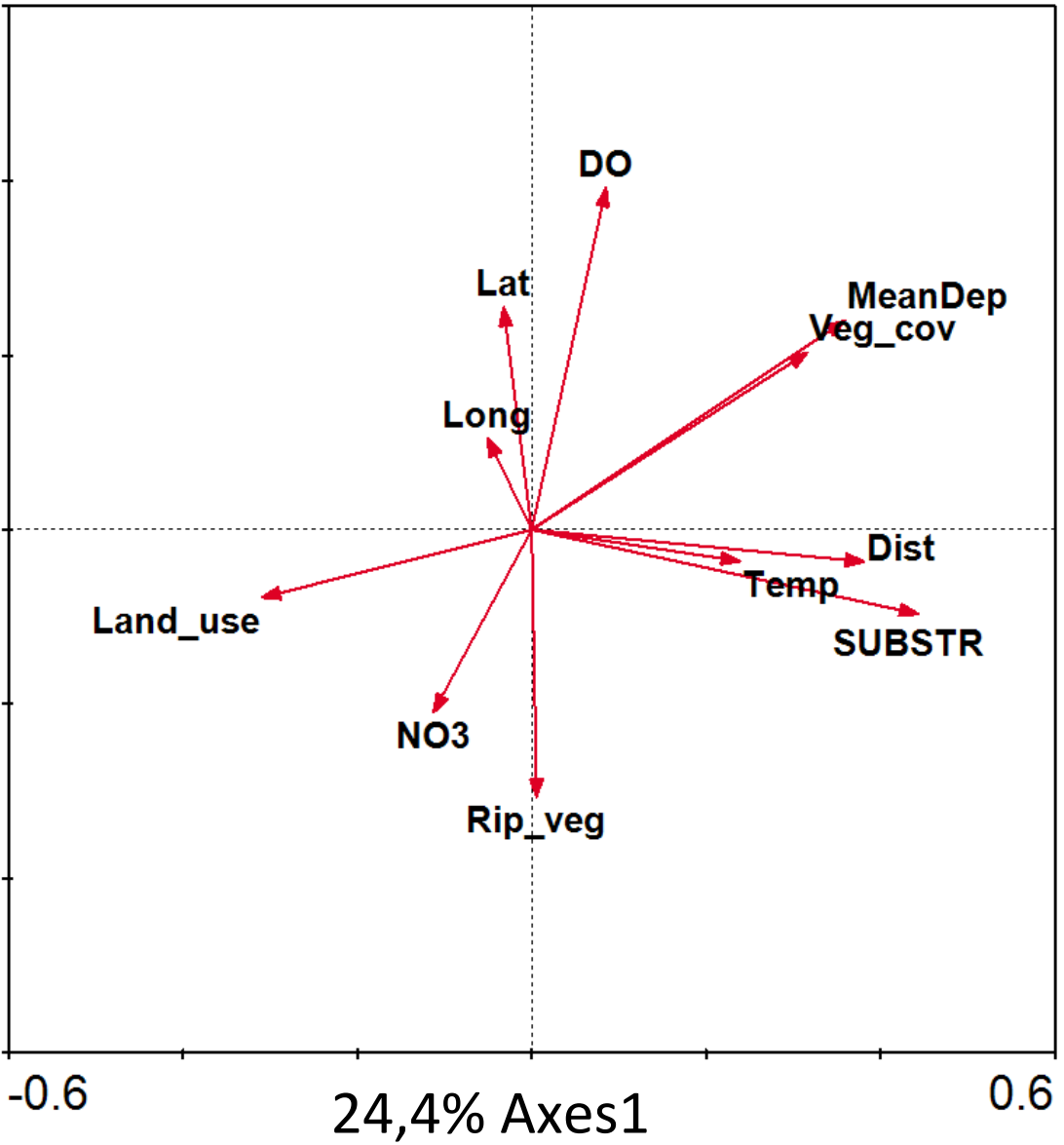
rgaref Index (d) has <u>POSITIVE</u> significant correlations with:

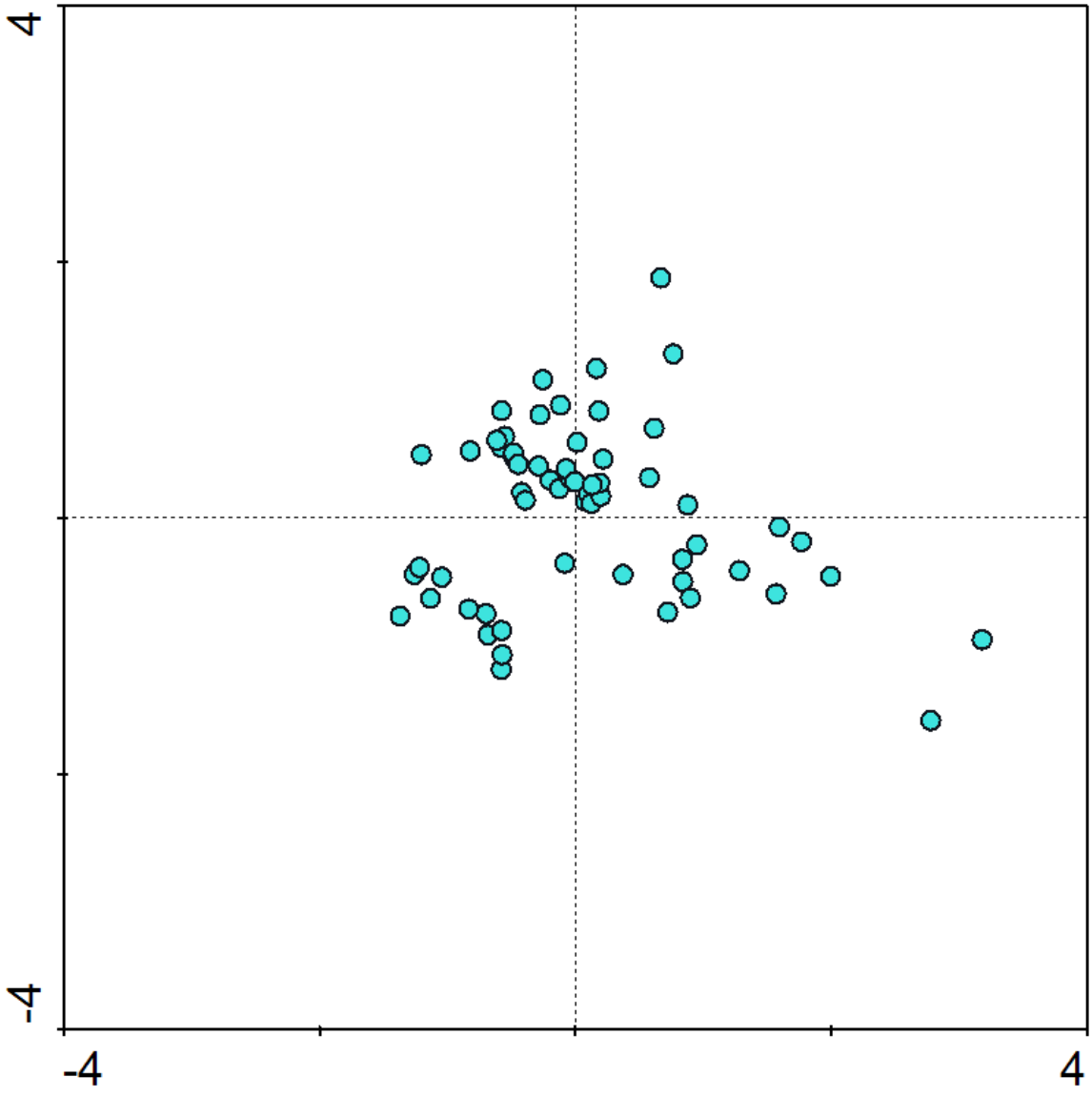
<u>Substrate (granulometry)</u>
Aquatic vegetation
Mean depth

d <u>NEGATIVE</u> with
Altitude
NO3
Temperature

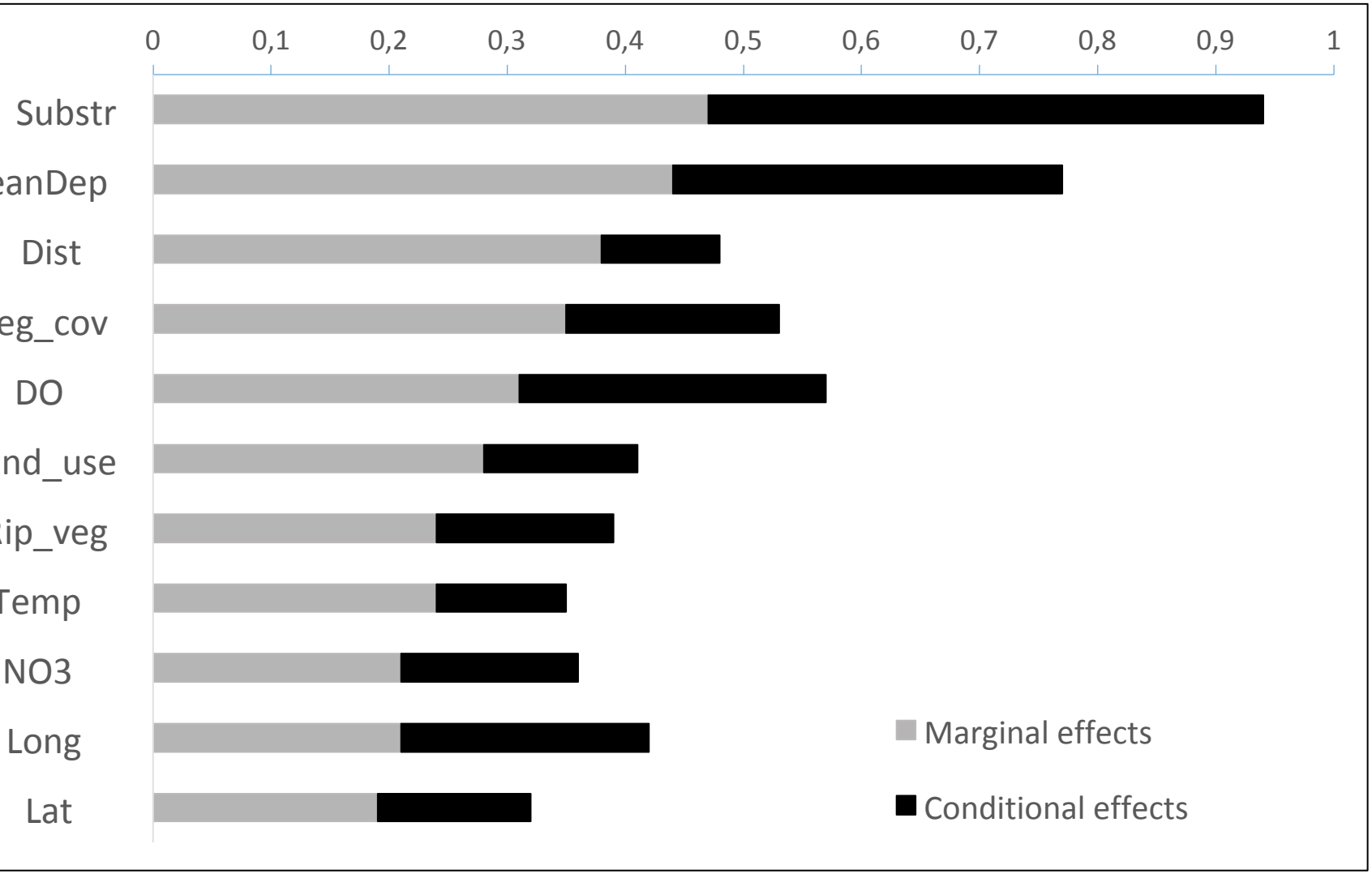


anonical Correlation Analysis (Tot variance explained 41,3%)



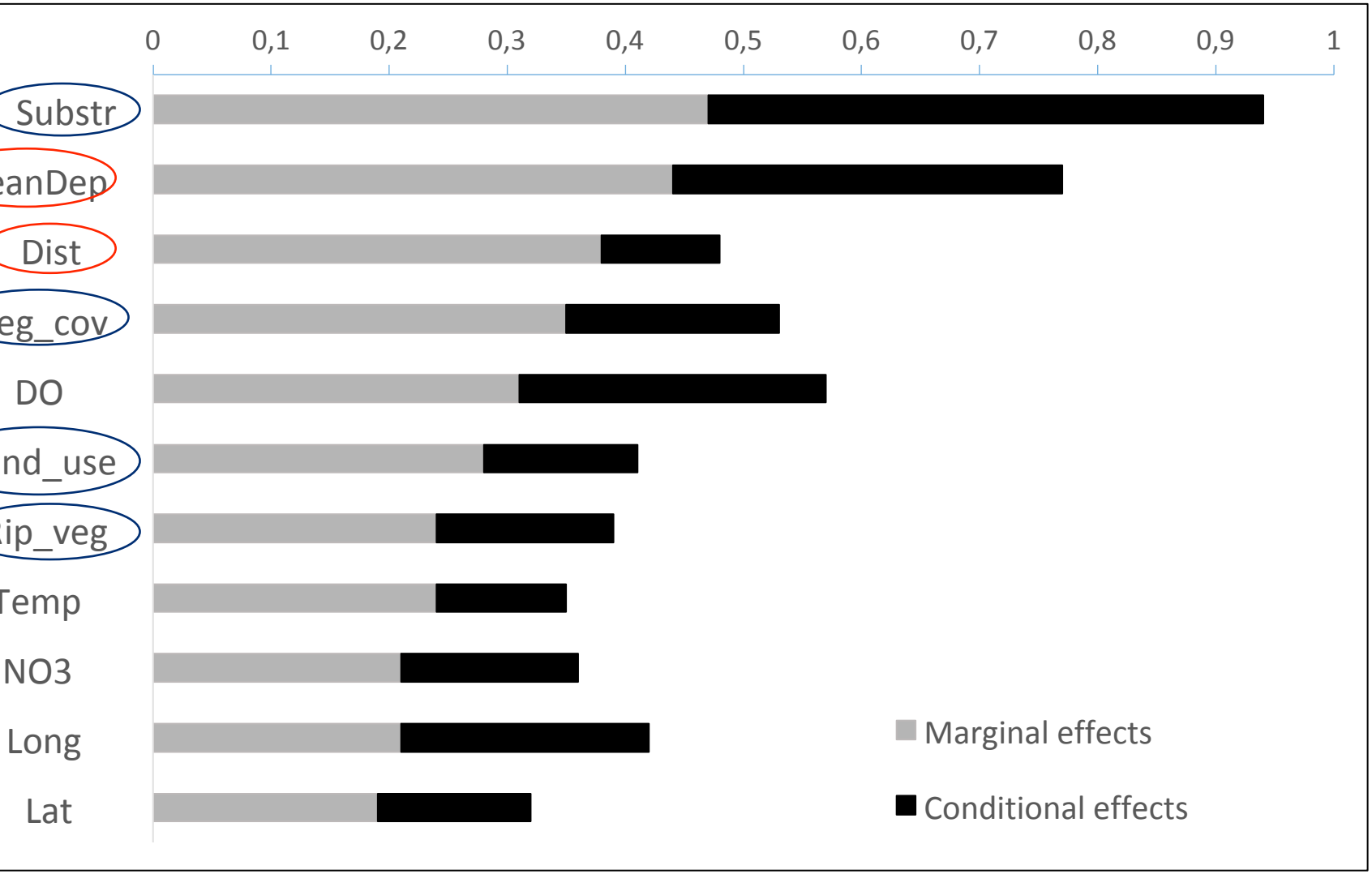


anonical Correlation Analysis



NH4 and **Alt** excluded for collinearity

anonical Correlation Analysis



NH4 and **Alt** excluded for collinearity

Key findings

- Structural indices cannot capture the variability of the dataset
- Granulometry is the most important parameter for benthic communites in headwaters
- Multivariate analysis highlights that both longitudinal and lateral dimensions are needed to describe the variability of macrobenthic communities
- Both RCC and RES models should be considered when modelling headwater living communities
- The combined effects of different variables play an important role

Future researches

- Including lower part of rivers into the analysis

- Including functional assessment of macrobenthic communities (functional groups, biological traits…)

Università degli Studi di Ferrara | Dipartimento di Scienze della Vita e Biotecnologie

Thanks for your attention…

LifeWatch ITALIA